

Historic, Archive Document

Do not assume content reflects current scientific knowledge, policies, or practices.

**PLANNING
CONSIDERATIONS
FOR
WINTER
SPORTS
RESORT
DEVELOPMENT**

0GV841
2
U5

**U.S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE
IN COOPERATION WITH
NATIONAL SKI AREAS ASSOCIATION**

1973



AD-33 Bookplate
(1-66)

NATIONAL

A
G
R
I
C
U
L
T
U
R
A
L



LIBRARY

DEVELOPMENT PLANNING—WINTER SPORTS RESORTS

FOREST SERVICE

U. S. DEPARTMENT OF AGRICULTURE

AND

NATIONAL SKI AREAS ASSOCIATION

U. S. DEPT. OF AGRICULTURE
NATIONAL AGRICULTURAL LIBRARY

MAY 1 - 1968

CATALOGING = PREP

PREFACE

Skiing is a sport of major importance on the National Forests and has begun to mold the growth and economy of many rural areas. Large segments of private lands are being developed without the benefit of city or county planning. The winter sports resort industry has matured and many operations are being conducted in a businesslike manner. The impacts of development are far broader than the resorts themselves. Entirely new communities have been established and existing ones revitalized or expanded. Year-long employment and greater stability has occurred. Many additional communities are expected to develop as all-seasons resorts.

Determining the location of these new resorts and communities involves the coordinated effort of the Forest Service, local government, Industry and the general public. Land suitable and available for development of winter resorts is limited and optimum use must be made of the space that is available. Resorts need good transportation and utility services which affect land far removed from the resort itself. The need for long-range planning is paramount.

Basic land use decisions must be made by the Forest Service before development is authorized. Environmental analyses, involving thorough study of multiple use alternatives, environmental alternative actions and public involvement are required by law.

This publication deals with broad policies involving resort development on the National Forests and adjacent lands; it

discusses details which must be considered in development plans. Plans must be dynamic, leaving opportunities for alternative actions. This is necessary since technology, social-economic-public needs are constantly changing. It deals primarily with planning the mountain rather than the community. The principles of community design involve a separate but equally important specialization. Application of the principles discussed here will vary widely from one area to another. Plans submitted to the Forest Service should show the relationship of the development to both public and private lands. An area of land for public recreation is being planned. Conceptual design is needed for the planning area before development commitments are made. Detailed location and construction plans should follow as individual projects are readied for development.

The National Forests are, and will continue to be, an essential element in winter resort area growth. While the proponents are responsible for preparation of plans, cooperation and coordination with the Forest Service throughout the planning process is essential. Publications and technical information of a wide variety are available from the Forest Service. Consultants and specialists are also available to assist planners.

Winter sports is an important industry and one which has a long-term effect on public lands and community development. If we are to continue to develop, we must demonstrate expertise and sensitivity in our planning.

TABLE OF CONTENTS

	PAGE
PREFACE	i
APPROVING SITES FOR DEVELOPMENT AS WINTER RESORT AREAS	1
FEASIBILITY STUDIES, LAND USE PERMITS AND DEVELOPMENT PLANS	3
Development of Areas in Conjunction with Private Land	3
Development of Areas Entirely on National Forest Land	3
Making Studies on National Forests	3
The Development and Operating Permit	3
Policy Regarding Development Plans	4
Separate Ski Areas Vs. Expansion of Existing Ones	5
CAPACITY AND QUALITY	7
Area Capacity	7
Private Land Compatibility with Public Land Management Objectives	9
Public Lands Provide Quality Recreation Opportunities	9
Other Goods and Services from Forest Lands	11
PRIVATE LAND COMMITMENTS	13
Planning of Public Facilities to Precede Private Land Commitments	13
Development to Provide Quality Public Skiing	15
The Total Resort Irrespective of Ownership Pattern	17
Skiing Quality Vs. Congestion	19

TABLE OF CONTENTS

	PAGE
Conceptual Planning Vs. Detailed Surveys and Construction	21
Large Resorts May Need Several Base Areas	23
Balancing Lift Location and Capacity	25
Identification of "Critical Points"	27
Utility Systems	29
Domestic Water	29
Sewage Treatment	29
Power Transmission and Telephones	29
Visual Considerations	30
Effects of Wind and Sun	33
Skier Safety and Avalanche Control	35
Ski Run Clearing and Construction	37
Soil Protection and Treatment	39
Soil Studies for Construction Plans	41
Aerial Photography as Used to Identify Resource Situations	43
Prediction of Water Runoff Patterns and Stream Flow Control	45
Air Quality Standards	47
Innovative Construction Methods	49
Roads to Serve a Ski Area	51
Roads and Development Costs Vs. Skiing	53
 ADDITIONAL INFORMATION	 55

APPROVING SITES FOR DEVELOPMENT AS WINTER RESORT AREAS

It is Forest Service policy to provide for the development of winter resort sites to meet public needs, where they are compatible with other resource values. Determining needs and compatibility is complex and may be a time-consuming process.

The Multiple Use-Sustained Yield Act of 1960 authorizes and directs the Forest Service to manage the National Forests under principles of multiple use and to produce a sustained yield of products and services, and for other purposes. The National Environmental Policy Act of 1969 directs the Forest Service to utilize a systematic, interdisciplinary approach to planning; to give environmental amenities and values appropriate consideration; to consider alternative courses; to involve the public and appropriate agencies; and to perform other procedures.

A proponent may apply for a permit to develop a resort area before the Forest Service has completed the land use studies necessary to designate an area for such use. If the proponent

wishes to move ahead rapidly, he will be expected to collect and provide to the Forest Service much of the ecological, social, technical and other data necessary for the preparation of the required environmental analysis or statements. Data collected by specialists, for the proponent, must be in a form which can be analyzed, supplemented, or used by the Forest Service.

Environmental analyses not only consider the various uses for which the land is suited, but also consider the feasibility of a site for a particular purpose. There are numerous sites that are physically feasible for winter resort development, but may not be acceptable for this purpose because of conflicting social, resource or other reasons. To determine the technical feasibility, extensive studies of factors such as terrain, weather, snow conditions, soil hydrology, access, economics, and environmental impact must be conducted. Sites will not be approved for use unless all appropriate analyses are favorable and approved by the Forest Service.

Aspen, Colorado, provides a preview of the future. Many communities now dependent upon mining or agricultural economies will experience rapid growth and change because of recreation resort development. Where mining activity is declining, resort development may stabilize the economy. These communities will develop many social, medical and business amenities which they now lack.



FEASIBILITY STUDIES, LAND USE PERMITS AND DEVELOPMENT PLANS

DEVELOPMENT OF AREAS IN CONJUNCTION WITH PRIVATE LAND

Proponents of a new area or expansion of an existing one will be responsible for preparation of feasibility reports. The Forest Service will make sufficient independent studies to verify data reported by a proponent and will determine what optimum level of development will be required to fulfill long-term public needs. Where the National Forest land can be developed from different private land ownerships, competition through prospectus may be required, regardless of who makes studies.

DEVELOPMENT OF AREAS ENTIRELY ON NATIONAL FOREST LAND

The Forest Service prepares feasibility studies preparatory to issuing a prospectus seeking development by a private party. The prospectus will state the minimum services to be provided and will normally include a sample permit showing other requirements. The bidders will be required to prepare a development proposal and show financial and managerial capabilities. The successful bidder will be issued a development permit, but might be required to refine his plan in order to overcome any shortcomings before proceeding with detailed construction plans.

MAKING STUDIES ON NATIONAL FORESTS

Individuals or groups may perform studies on National Forest lands without a permit. However, when equipment or facilities

must be installed, permits will be required for those improvements. This procedure allows more than one proponent, as well as interested members of the public, to study an area concurrently. The cutting of trees, or other changes in the forest condition, also requires a permit. PERMISSION GRANTED TO COLLECT DATA AND MAKE STUDIES DOES NOT GUARANTEE THAT A DEVELOPMENT PERMIT WILL EVENTUALLY BE ISSUED, EVEN IF AN AREA PROVES TO BE TECHNICALLY AND ECONOMICALLY FEASIBLE.

THE DEVELOPMENT AND OPERATING PERMIT

The successful proponent is issued a Term Special Use Permit. This is the contract and operating agreement between the Forest Service and the proponent. This permit covers an area up to 80 acres, usually where the major capital investments are located. It is issued for a period up to 30 years. A companion Special Use Permit would be issued for the additional area needed for the development of ski runs and other improvements. The Forest Service may not terminate the Term Special Use Permits, except upon breach of the permit terms by the permittee, without due compensation. The permits may be renegotiated during this term to provide for additional development, or to update the permit provisions, if agreeable to both parties. When an added commitment is made to provide improved or additional services and capital investments, the term of the permit may be extended to cover a maximum of 30 years. Normally when permits are issued for new development resorts, a period of about two years is allowed for the completion of development plans, financial arrangements and other matters. If these requirements cannot be completed, the permits might be subject to termination.

POLICY REGARDING DEVELOPMENT PLANS

Development plans for all new or enlarging resort developments on National Forests must be approved by the Forest Service before construction may begin. Plans must show the development concept for the entire area under consideration. They should represent the best thinking available at the time. Situations change and development plans should change accordingly. When significant changes are made, reapproval of the plan by the Forest Service is required.

The winter resort industry has been the catalyst for the accelerated growth of resort communities during the past decade. Development plans can no longer be limited to such items as skiing facilities, lodges and runs. While the winter sports developments may constitute the initial phase of development, an all-seasons resort and community complex must be anticipated. Land suitable for these purposes is limited and, therefore, the optimum development of each site must be planned initially.

The interdisciplinary approach to planning is required. Specialists in ecology, skiing, soil, hydrology, business and accounting, engineering, community planning, architecture, landscape management, forestry and other appropriate disciplines should be involved. Their team efforts should be directed by capable management, which will usually involve both the developer and the Forest Service.

SEPARATE SKI AREAS VS. EXPANSION OF EXISTING ONES

Under certain circumstances, established ski areas can be expanded substantially beyond that authorized by the original permit. In other cases, adjacent areas may have to be developed as separate areas. In all cases, new Special Use Permits, or amendments to existing ones, will be required.

Expansion of an existing area may be permitted when:

1. It is not feasible to develop an expansion area separately.
2. It is feasible to develop a separate and viable area, but the original permittee controls all of the key base property.
3. The two areas will be connected by a series of lifts and ski trails in a manner which enables them to be operated as a unit.
4. The landownership pattern is such that optimum development of the expansion area can be achieved.
5. The Forest Service has agreed that expansion is timely and in the public interest.

A separate permit, or advertisement of a prospectus, will usually be required when:

1. It is feasible to develop the area separately.
2. There is a competitive demand by other persons to develop the area. Sometimes this can only be determined by the advertising of a prospectus.
3. The controlling key base lands and ski slopes are controlled by a public agency or agencies, or by more than one private landowner.
4. It may not be logical to tie two adjacent areas together.
5. The developer wishes to have a separate area under a new permit, but does not wish to have the permit for the existing area changed.

At Breckenridge, Colorado, expansion of the existing area was permitted because the two areas complement each other, and could be interconnected; the permittee agreed to provide the required public facilities and services; landowners controlled both base properties agreed to work together and to provide permanent skiing and parking easements on the private land; and the existing community benefits from such arrangements.

Proposed and existing chairlifts. 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400 401 402 403 404 405 406 407 408 409 410 411 412 413 414 415 416 417 418 419 420 421 422 423 424 425 426 427 428 429 430 431 432 433 434 435 436 437 438 439 440 441 442 443 444 445 446 447 448 449 450 451 452 453 454 455 456 457 458 459 460 461 462 463 464 465 466 467 468 469 470 471 472 473 474 475 476 477 478 479 480 481 482 483 484 485 486 487 488 489 490 491 492 493 494 495 496 497 498 499 500 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515 516 517 518 519 520 521 522 523 524 525 526 527 528 529 530 531 532 533 534 535 536 537 538 539 540 541 542 543 544 545 546 547 548 549 550 551 552 553 554 555 556 557 558 559 560 561 562 563 564 565 566 567 568 569 570 571 572 573 574 575 576 577 578 579 580 581 582 583 584 585 586 587 588 589 590 591 592 593 594 595 596 597 598 599 600 601 602 603 604 605 606 607 608 609 610 611 612 613 614 615 616 617 618 619 620 621 622 623 624 625 626 627 628 629 630 631 632 633 634 635 636 637 638 639 640 641 642 643 644 645 646 647 648 649 650 651 652 653 654 655 656 657 658 659 660 661 662 663 664 665 666 667 668 669 670 671 672 673 674 675 676 677 678 679 680 681 682 683 684 685 686 687 688 689 690 691 692 693 694 695 696 697 698 699 700 701 702 703 704 705 706 707 708 709 710 711 712 713 714 715 716 717 718 719 720 721 722 723 724 725 726 727 728 729 730 731 732 733 734 735 736 737 738 739 740 741 742 743 744 745 746 747 748 749 750 751 752 753 754 755 756 757 758 759 760 761 762 763 764 765 766 767 768 769 770 771 772 773 774 775 776 777 778 779 780 781 782 783 784 785 786 787 788 789 790 791 792 793 794 795 796 797 798 799 800 801 802 803 804 805 806 807 808 809 810 811 812 813 814 815 816 817 818 819 820 821 822 823 824 825 826 827 828 829 830 831 832 833 834 835 836 837 838 839 840 841 842 843 844 845 846 847 848 849 850 851 852 853 854 855 856 857 858 859 860 861 862 863 864 865 866 867 868 869 870 871 872 873 874 875 876 877 878 879 880 881 882 883 884 885 886 887 888 889 890 891 892 893 894 895 896 897 898 899 900 901 902 903 904 905 906 907 908 909 910 911 912 913 914 915 916 917 918 919 920 921 922 923 924 925 926 927 928 929 930 931 932 933 934 935 936 937 938 939 940 941 942 943 944 945 946 947 948 949 950 951 952 953 954 955 956 957 958 959 960 961 962 963 964 965 966 967 968 969 970 971 972 973 974 975 976 977 978 979 980 981 982 983 984 985 986 987 988 989 990 991 992 993 994 995 996 997 998 999 1000 1001 1002 1003 1004 1005 1006 1007 1008 1009 1010 1011 1012 1013 1014 1015 1016 1017 1018 1019 1020 1021 1022 1023 1024 1025 1026 1027 1028 1029 1030 1031 1032 1033 1034 1035 1036 1037 1038 1039



PUBLIC PARKING

SKEW
RIGHT
OF
WAY

CAPACITY AND QUALITY

AREA CAPACITY

The number of people that should be accommodated varies widely because of topography, snowfall, esthetics, limitations of either the base or the mountain and many other factors. Whatever the optimum number might be, space must be reserved at the base to provide parking and the service facilities which ultimately will be needed.

The acreage suitable for base facilities varies widely among areas. To a great degree, it determines if an area can be developed to community proportions or if the area's success is dependent upon people within commuting distance. The Forest Service recognizes the expense of developing a resort area and that land sales or leases are often needed to recover initial development costs within a reasonable period of time. There must be a balance between the development opportunities on the mountain and at the base area.

Photographs used in this publication show many run designs and patterns. Reasons vary. Skiing quality is a major factor since

skiers do not like crowding or congestion, poor snow conditions or poorly designed trails. If the skiing difficulty of a trail changes, it will hinder skiers who cannot easily negotiate the most difficult sections. It may be necessary for run location to be manipulated in order to create an ideal proportion of beginner, intermediate and advanced or expert trails. To do so may lower the capacity of an area, but increase its popularity and viability.

Heavy skier use can wear out snow, particularly in congested areas. Snowmaking, dispersing of skiers and lift, trail and facility distribution can be used to increase the capacity of an area. Wind, unstable soil conditions, uncontrolled flowing water, esthetics and snow conditions such as avalanche can reduce the capacity if not considered in planning.

Determining the optimum capacity involves many technical, economic and social disciplines. It is both a subjective and physical matter. It is time consuming and expensive to determine, but an essential element in area planning.

Base lands at this resort have been committed to a development pattern. Extensive undeveloped skiing terrain remains which can accommodate thousands more skiers. Base area planning and better space utilization and commitment to long-term use is needed to provide parking and other facilities for these people.



Public lands may not be developed if the use creates changes which are contrary to the requirements of the National Environmental Policy Act of 1969. Consequently, proponents must plan to develop the private lands to be in character with the National Forest environmental objectives.

Private land values near resort areas are largely dependent upon the location of base facilities to ski lifts or scenic terrain. The Forest Service is principally interested in obtaining optimum recreation development to serve the general public.

As all seasons resort communities develop near ski areas, the skiing slopes become important hiking and recreation areas. This changing use should be considered when developing an area, since the beauty of the mountain itself during the summer will affect the attractiveness of the area as a resort.

[illegible]

Existing ski lifts ■■■■■■



OTHER GOODS AND SERVICES FROM FOREST LANDS

The timber values on an area may be high enough to warrant commercial sales. The economic and social benefits of placing this material on the market cannot be overlooked. Additional time may be needed in order to provide for sale and removal of merchantable timber. Timber management planning and area development planning should be performed concurrently.

Timber contractors have a responsibility to perform logging operations in a manner which is consistent with the long-term use of the land. The necessary practices for the integrated use of the land will be formulated and required in contracts and permits.

Removal of forest products by the ski area permittee or contractor may be necessary or desirable as an alternative to disposal.

The forest area remaining between ski runs may deteriorate significantly over time, if it is not managed. Exposing trees to wind and sun often accelerates problems. Perpetuating the

viability of the ski resort is the primary consideration. Some young forests might best be thinned in order to maintain strong individual trees. Older forests might need treatment in order to allow growth of younger trees.

Transportation planning is an integral part of the planning process. It must reflect the needs of the future for goods and services to come from the area and its surroundings. It must reflect the demands created by a new community. The Forest Service will perform the transportation planning necessary for the multiple use management of the extensive forest areas, which include and surround a ski resort. In some cases, planning for development or management of resources adjacent to a ski resort may not be complete at the time a permittee wishes to develop a ski area. Development of road systems, inside or outside of the permit area, may have to be deferred if a permittee wishes to accelerate his development. In such cases, alternative methods of facility construction may have to be used which do not require roads.

Maps showing the location of commercial timber on the National Forests are available at Supervisors' Offices. This and other resource data are available in various forms. In some areas, the resource capability of land is being computerized. This will aid planners in making management and development decisions.

FOREST TYPE SYMBOLS

Commercial

- P Ponderosa Pine
- LP Lodgepole Pine
- WLP Whitebark, Limber or Bristlecone Pine
- SF Engelmann, Blue or Black Hills Spruce
- Alpine & Corkbark Fir
- D Douglas Fir
- DS Dead Spruce
- WF White Fir
- A Aspen
- Co Cottonwood
- OH Other Hardwoods

Non Commercial

- NA Aspen
- NC Chaparral (Oak Brush, Dwarf Trees, etc.)
- NPJ Pinyon, Juniper
- NO Others

Non Forest

- NF Grass, Rock, Cultivated Land

Stand Size Class

- 6 Non Stocked or Deforested (burns, clearcuts)
- 7 Seedling, Sapling, 0" to 4.9" d.b.h.
- 8 Pole 5.0" to 10.9" d.b.h.
- 9A Small Sawtimber 11.0" to 20.9" d.b.h.
- 9B Large Sawtimber 21.0" and over d.b.h.

Crown Density

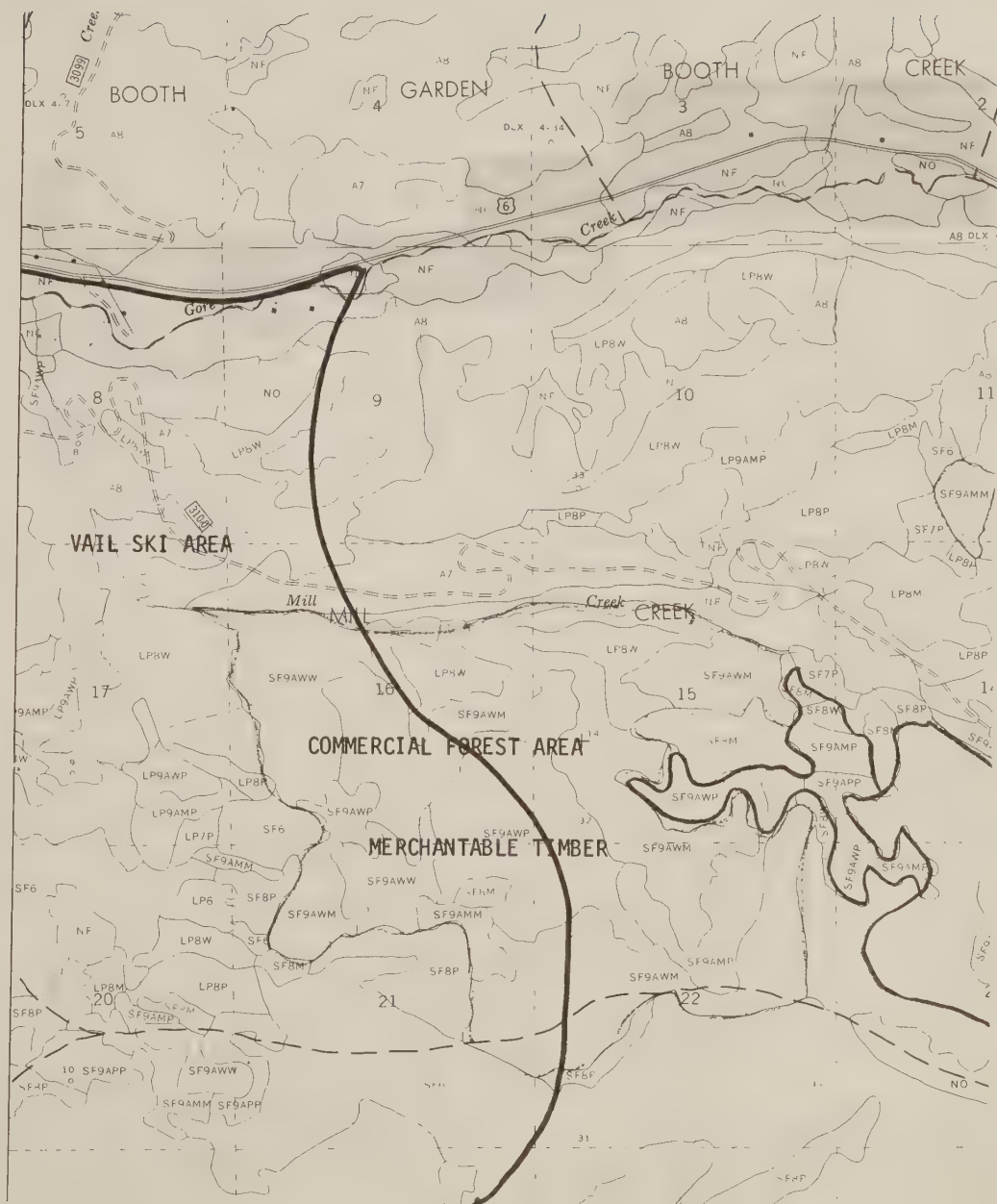
- P Poor 10% to 39%
- M Medium 40% to 69%
- W Well 70% to 100%

Use dual density symbols for sawtimber stand. First symbol refers to stocking on the basis of total crown cover. Second symbol refers to stocking by sawtimber crowns only

EXAMPLE

SF9AWW Spruce, Small Sawtimber, well stocked on total crown basis, medium stocked on sawtimber crown basis

- Compartment Boundary
- Working Circle Boundary



PRIVATE LAND COMMITMENTS

PLANNING OF PUBLIC FACILITIES TO PRECEDE PRIVATE LAND COMMITMENTS

The general location of skiing runs within a ski area should be determined before any land sale or development begins which could conflict with optimum development of the area. This is particularly important adjacent to proposed base areas. Vehicle, pedestrian and skier traffic flow should be planned to anticipate long-range circulation patterns.

Skier access trails across private land must be reserved for future development before subdivisions are platted and roaded. Access roads and adequate parking must be platted and dedicated to that purpose or other adequate provision made for public transportation. During the conceptual planning process, these general needs should be identified. Before actual lift and trail construction, or private land subdivision, precise location and land commitment must be made.

Trail clearing alters water runoff rates and patterns which might affect private land development. Water drainage changes should be anticipated during planning and provisions made for controlling water from ski runs and through the development areas.

Private lands were sold adjacent to proposed ski slopes before trail location and design was planned. Proposed new lifts will increase the demands in this area for parking and will add to the congestion where ski trails converge. Snow wear is a major problem because of heavy and concentrated skier traffic. This base area must be designed to accommodate the optimum capacity of skiers which will eventually be served on the slopes.

Increased water runoff from cleared slopes has been allowed to flow through private homesites. Flow increases can be predicted and provisions made to control these flows.

Gondola lift 

Chair lifts 

Private—National Forest Property Line 





THE TOTAL RESORT IRRESPECTIVE OF OWNERSHIP PATTERN

All facilities needed to operate a public recreation winter resort area may be located on National Forest land. Private residences are examples of facilities that are not permitted. Public motel or hotel accommodations are allowed and encouraged. Plans and specifications must be reviewed and approved for all facilities installed on National Forest lands. The Forest Service requires that federal, state, and local codes be met.

The quality of a public recreation area or resort should not be compromised merely to keep base area facilities on private land. The area should be planned as a unit irrespective of ownership boundaries.

Permit fees for concessionaires using National Forest lands are based upon the total private investment in facilities or improvements necessary for operating an area, whether they are located on private or public lands. As the investment in public service facilities increases, the fee percentage decreases.

Boundary adjustments can be made if plans indicate that the optimum development will be facilitated.

Private land to the left of the highway should remain undeveloped to preserve scenic backdrop. A trade could be arranged for appropriate developable land adjacent to the ski terrain at right.



Two types of ski slope design are evident at the Buttermilk Ski Area. Skiers using the slopes at the right can ski without interference by skiers coming from either side. If a mountain is designed permitting inter-connecting, but separate ski run systems, a skier can have the feeling of isolation and freedom from congestion. Open slopes are also desirable if they do not create congestion or over-use of critical areas.

When designing a system of lifts and trails, the ultimate development should be planned in order that future lifts and additional trails will not create conflict, congestion, crowding or worn out snow conditions. Varying lift unloading patterns can direct skiers into preferred trail systems to improve trail utilization or avoid congestion.

Unneeded construction roads have been regraded to the original contour. New technology is permitting lifts to be constructed without the need for road construction which is time consuming, adds expense and possible damage to skiing quality.

□ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □



CONCEPTUAL PLANNING VS. DETAILED SURVEYS AND CONSTRUCTION

Ideas that appear valid during initial planning are often found to be shortsighted as planning progresses and future development is considered. Lift lines, ski runs, survey lines and other clearings have been made which have never been used. These create an unnecessary and unnatural impact on the landscape. They are also expensive.

During the planning period, only minimal manipulation of the terrain and vegetative cover is permitted. This maintains the maximum options until plans and development schedules are finalized.

If construction or facility plans precede conceptual plans, overall quality and public service are seldom the guiding principles.

The ski lift clearing in the center was never used. A chairlift crosses this line in order to serve the terrain at the right. This impact could have been avoided.

The chairlift illustrated moves skiers uphill from both the left and right of the picture. They are unloaded near the cleared lift line in the center.

As additional ski terrain is developed at the far right, new means must be devised to return skiers to the base area at the left.

Existing chairlift

Proposed chairlift



LARGE RESORTS MAY NEED SEVERAL BASE AREAS

Many areas have total elevation rises of several thousand feet. Numerous lifts are located on the upper slopes, far removed from the base area and service facilities. Steeper slopes often separate the base from the gentle, more popular slopes above.

More lifts may be needed merely to get skiers out of a base area in the morning than are needed to serve skiing slopes near the base area. Skiers returning to the base at the end of the day, or for lunch, may create congestion problems.

Too many skiers using a few trails not only causes congestion, but frequently wears out the snow. In the Rockies and the East this is a serious problem at many base areas where snow depth is minimal. If the snow wear problems cannot be designed for, expensive snowmaking equipment may have to be installed.

Multiple base areas may be required in order to minimize congestion. If the ultimate capacity of the mountain is determined initially, a proper balance of lifts, runs and base facilities can then be designed. Secondary base areas should be recognized early in the planning stage.

Because of topography, few runs can serve the initial base area at this ski area. A second base area will be needed to accommodate the number of skiers to realize the area's potential. Two day lodges will eventually be needed high on the mountain, in addition to facilities at the base areas. Facilities like this are costly. The location for all of these facilities should be planned initially, so the proper balance is achieved when the area is fully developed and cost benefit alternatives can be considered.

Because surveys were made before conceptual planning was complete, one lift line was partially cleared and was later abandoned.

Existing chairlifts



BASE 2

BASE 1

BALANCING LIFT LOCATION AND CAPACITY

When the majority of the ski lift capacity is far removed from the base area, it is important that the lifts be located and have sufficient capacity to: (1) provide for efficient distribution of skiers throughout the lift system and area in a reasonable amount of time and, (2) provide ski lift capacity for skiers not wishing to use lifts far removed from the base area.

A variety of factors should be considered. Some of the more important ones include:

- a. Vertical feet of skiing per day by average skier ranges from 7,000 to 11,000.
- b. The out-of-base lift capacity as a percent of the overall mountain lift capacity.
- c. Lifts that do not provide access to remote lifts are not counted, except as they serve skiers wishing to remain adjacent to the base area.
- d. Working efficiency of the lifts, as compared to maximum design capacity.
- e. Opening time of lifts, as it relates to moving skiers to slopes by mid-morning.
- f. Providing for skier return early and late in season when lower slopes may be short of snow. Lower than average number of skiers during this period may offset this problem.
- g. Wearing out snow at base area if concentration of skiers is too great.

Lift System "A" is in balance providing sufficient capacity out of the base to serve the more remote lifts and to permit a reasonably long day at full capacity of these remote lifts.

Lift System "B" provides recirculating skiing for those not wishing to leave the base area until the out-of-base lift system has moved skiers from the base to the remote lifts.

Lift System "C" would provide extra lift capacity in the remote areas, but would reduce the overall efficiency of the remote lift system until additional access could be provided out of the base area.

Without a new base area, the remaining suitable, but undeveloped remote skiing terrain, could not be utilized efficiently. If too much capacity was developed out of the original base area, these access lifts would not be fully utilized after skiers were moved to the remote areas. Snow wear might become excessive at the relatively constricted return route (X) at the base.

Lift System "A"

Lift System "B"

Lift System "C"



IDENTIFICATION OF "CRITICAL POINTS"

Good long-range plans are flexible enough to permit changes which could not be anticipated initially. However, it is often necessary to intensively plan certain "Critical Points" to ensure that a variety of options can be followed in the future. Expensive facilities have often been installed and later modified or removed in order to allow for the orderly and proper expansion of the area.

These critical situations take many forms—base areas, key skier circulation areas, avalanche paths, unstable soils, skier concentration and service areas, etc. Since very large capital expenditures must be made at centralized service centers served by several lifts, it is important that the proper sites be selected. Unless the long-term possibilities are recognized initially, changes may be prohibitively expensive.

Key service and distribution centers located high on the mountain have been developed at major resort sites. Because additional development needs were later recognized, some resort areas are now almost irreversibly committed to either inefficient operations or less than optimum development.

This hill top is critical to skier access and distribution. Factors which must be considered when planning sites like this include:

- a. Space for top terminals of all anticipated lifts and room for skier unloading.
- b. Location of water storage tank and pipe lines which will not conflict with other facilities.
- c. Restaurant facilities and space for the largest development anticipated.
- d. Location of electrical terminals and distribution lines for all planned facilities.
- e. Space for sewage disposal system.
- f. Effect wind might have on the site after timber has been cleared and facilities installed. Snow could blow away. Wind could cause slowdown or stoppage of lifts critical to movement and dispersal of skiers, or reduce comfort and safety of people.
- g. Movement of skiers away from lift unloading areas and toward restaurant or ski runs.
- h. Esthetics of the site after development is complete.
- i. Ability of the soil to accommodate the development
- j. Ski racks and other space-using items.

[illegible]



UTILITY SYSTEMS

Domestic Water

New resort communities must anticipate their water needs. Plans must provide for this impact which the resort itself has created. Maintenance of water quality is not only important to the new community, but to the downstream user as well. Because of prior claims, sufficient water rights may not be available for new resort or community development. Sufficient rights must be acquired not only for the domestic use, but for any snowmaking needs as well.

Sewage Treatment

Treatment of sewage receives close scrutiny. Before construction of treatment facilities is authorized, plans must be reviewed and approved by agencies such as the Federal Water Quality Administration, the State and County Health Departments and the Forest Service. This may be a time-consuming process, but cannot be short cut at the expense of public health. Many of the areas suitable for future development of winter resort areas lie high in the headwaters of domestic watersheds. In such situations, waste water must receive complete treatment before being released.

Power Transmission and Telephones

Power lines and telephone cables which are visible from the base or lift-served areas must be underground. Consequently, a thorough knowledge of future lift and run locations is needed before any proposals are made to install lines to lifts and buildings. It will be most efficient if the approximate location of all distribution line needs can be determined during the planning stage.

It may take a great deal of lead time for utility companies to provide new transmission line service to an area. Basic needs should be estimated several years in advance. Utility consultants can often save both time and money. Independent contractors bidding on specifications provided by consultants can frequently cut the cost of utility company proposals.

VISUAL CONSIDERATIONS

Skiing is but one of many recreation uses of the National Forests. Although it is one of the fastest growing sports in the nation, it represents only a small portion of the total recreation use. The public has become more aware of and concerned about the environment and the developments on and adjacent to the public lands.

Many of the potential winter resort areas are readily visible from major highways and from other heavily used recreation areas. The amount of landscape modification permitted will vary greatly with slope, aspect, vegetation color and texture, type of terrain and distance from the viewer.

A variety of methods to lessen impacts should be considered in planning. Runs can be shaped and natural openings used to minimize straight line effect. Feathering and scalloping of trail edges, thinning or glading of timber, creating natural appearing openings, are effective methods. Lift lines can be blended into ski runs, topography and natural openings. Roads can be minimized, eliminated, or designed and screened in a manner that will not detract from the esthetics.

Areas of high and low visual impact can be mapped, using contour maps and sight lines from key viewing areas. Photographs from the air and from viewing areas can be used to identify situations and relate them accurately to locations on the ground.

Copper Mountain, adjacent to Interstate 70 Highway, is viewed by thousands of travelers each year who are driving through the Rocky Mountains primarily to enjoy the mountain scenery. A completely natural appearance is not necessary, however every effort must be made to minimize the impacts.

The extra effort may not be more expensive than practices followed in the past. Many relatively unpopular ski runs have been cleared at great expense. Even large portions of many popular trails receive little or only moderate use. Thorough planning of road and trail systems and base areas can produce both good skiing and an esthetically pleasing appearance. Development of both the public and private lands for winter resorts must protect the character and charm of this magnificent scenery.

The following two pages show Copper Mountain, as seen from Interstate 70, and also as seen from the air. The view from the highway is pleasing, and although the aerial view is more of an impact, it is a satisfactory compromise to achieve the ground view and functional utility.





GROUND
PHOTO

EFFECTS OF WIND AND SUN

The problems of developing ski areas above timberline in the Rocky Mountains are fairly well known. The chilling wind can be very uncomfortable and even dangerous to the skier. Snow is easily blown away, exposing rocks. Lifts in these exposed areas have not generally operated efficiently. "Down time" has been much greater when compared to lifts located in protected areas. Avalanche hazards tend to be more prevalent and more difficult to control. Development in such locations will normally be allowed only to augment more protected systems.

There are many examples where clearing of trees below timberline exposed the ground and snow to winds, making runs unusable for all or significant parts of the skiing season. Usually, these clearings have been authorized because the proponent insisted that he had made adequate, but improperly documented, wind and snow studies.

Alignment of ski trails in relation to wind direction is a key factor. Thorough knowledge of wind direction and speed and its effect is a prerequisite to ski run clearing. One effective planning practice has been to locate wind instruments above the trees for extended periods of time and to move them throughout the

planning area, recording the presence or absence of wind in the process. In some cases, limited clearing has been authorized in order to verify snow deposition and wind conditions. Research data are available which show the effects of wind on snow deposition and scour, under a variety of run or clearing conditions. The presence or lack of wind effect on living trees can be a clue to wind situations.

Where wind is known to cause scouring problems, studies and tests should be conducted to determine if snow can effectively be drifted onto proposed runs and held there.

Clearing should be done gradually, preferably beginning at least one year before lifts are to be installed. As more knowledge is gained about an area, this becomes less important. It is easier to come back for additional cuttings than to install snow fences and attempt to regrow trees.

The sun's effect can have devastating consequences on snow depending upon the season, slope, aspect, vegetative cover and height of cover adjacent to planned runs. Planners must always be alert to the possibility that wind or sun might be limiting factors.

The area shown here had adequate snow depth before the timber was cleared. The new chairlift did not operate the first two winters after it was installed.



SNOW FENCE

SCOUR

SKIER SAFETY AND AVALANCHE CONTROL

The costs of effective snow safety programs are continually underestimated by area planners and developers. Perhaps it is a misunderstanding of the problem. Consequently, very many large and modern ski areas in the United States face continuing problems and annual expenses which far exceed the amount the area's planners originally spent to evaluate the situation.

Typical problems include:

Small inconspicuous slide paths are a major hazard. The large paths are usually well identified.

Skiers looking for powder snow in the trees adjacent to cleared slopes often are unaware of hazards.

Roads, parking lots, buildings, lift terminals and towers are still proposed in slide paths. Planners spend insufficient time in the field immediately after storms, or during hazard conditions, to recognize these hazards. Identifying them during the summer is often difficult. Historical data should be obtained.

Ski area operations are often complicated or disrupted by avalanche problems.

In complex situations, a large number of snow safety technicians are needed to ensure public safety. Area layout should be such that segments of the area can always be operated while control is being carried out in the more hazardous areas.

The need for artillery or recoilless rifle control measures should be avoided. This equipment may not be available indefinitely. Ammunition and control crews have become a greater expense to permittees. An area should be planned so control teams can get above the hazards using ski lifts. Teams should be able to ski down to control areas and control by protective skiing or use of hand charges.

Caring for avalanche weather forecasting instruments and collecting and analyzing data is time consuming, expensive and essential at high hazard areas. Permittees are expected to own, operate and use this forecasting equipment.

Where avalanche hazards exist, preliminary safety and operating plans, along with cost analyses, should be part of the development plan.

Chairlifts

Surface lift—Access to avalanche control areas



SLIDE AREA

SKI RUN CLEARING AND CONSTRUCTION

When large areas are cleared, the effects can be severe. The snowpack character changes on ski runs and the amount and rate of the spring runoff is also altered. Percolation of snowmelt into the soil is reduced, further aggravating the runoff situation. The runoff must be controlled in order to prevent soil loss and impairment of water quality. Planning is required in order to stabilize the soil between the time of clearing and the fall. Water runoff in the spring must be anticipated and provisions made to control or regulate it.

Both soil and hydrology studies are necessary as a basis for land clearing and slope grading proposals. Planners should know precisely what areas will require machine shaping. Plans should show how the ground will be reshaped and how the cut and fill sections will be stabilized. The effect of clearing on soil moisture content should be anticipated and adverse effects controlled. Adverse effects on aesthetics must also be analyzed. Bulldozing will not be allowed simply to minimize clearing or slope maintenance costs. The Forest Service recognizes the need for well groomed ski slopes. Therefore, shaping may be allowed when a plan shows how it will be done and how the land will be stabilized.

Fertility and depth of soil varies widely. Practices that may be allowed in one area may not be acceptable elsewhere. Surface erosion requires a different treatment and prescription than an area where the entire landmass is unstable. Landslides are common occurrence at some areas when soil becomes saturated.

The large landslide at the upper left occurred many decades ago. It indicates mass soil instability.

Slopes below timberline can usually be revegetated. When disturbed, the thin soils above timberline are restored only at great expense.



SOIL PROTECTION AND TREATMENT

Before a site is approved for resort development, a preliminary soils report must be prepared as part of the environmental analysis. It is through this analysis that the basic land use decisions are made. The preliminary soils report is general in nature and estimates the suitability, hazards, and limitations of the area for various impacts.

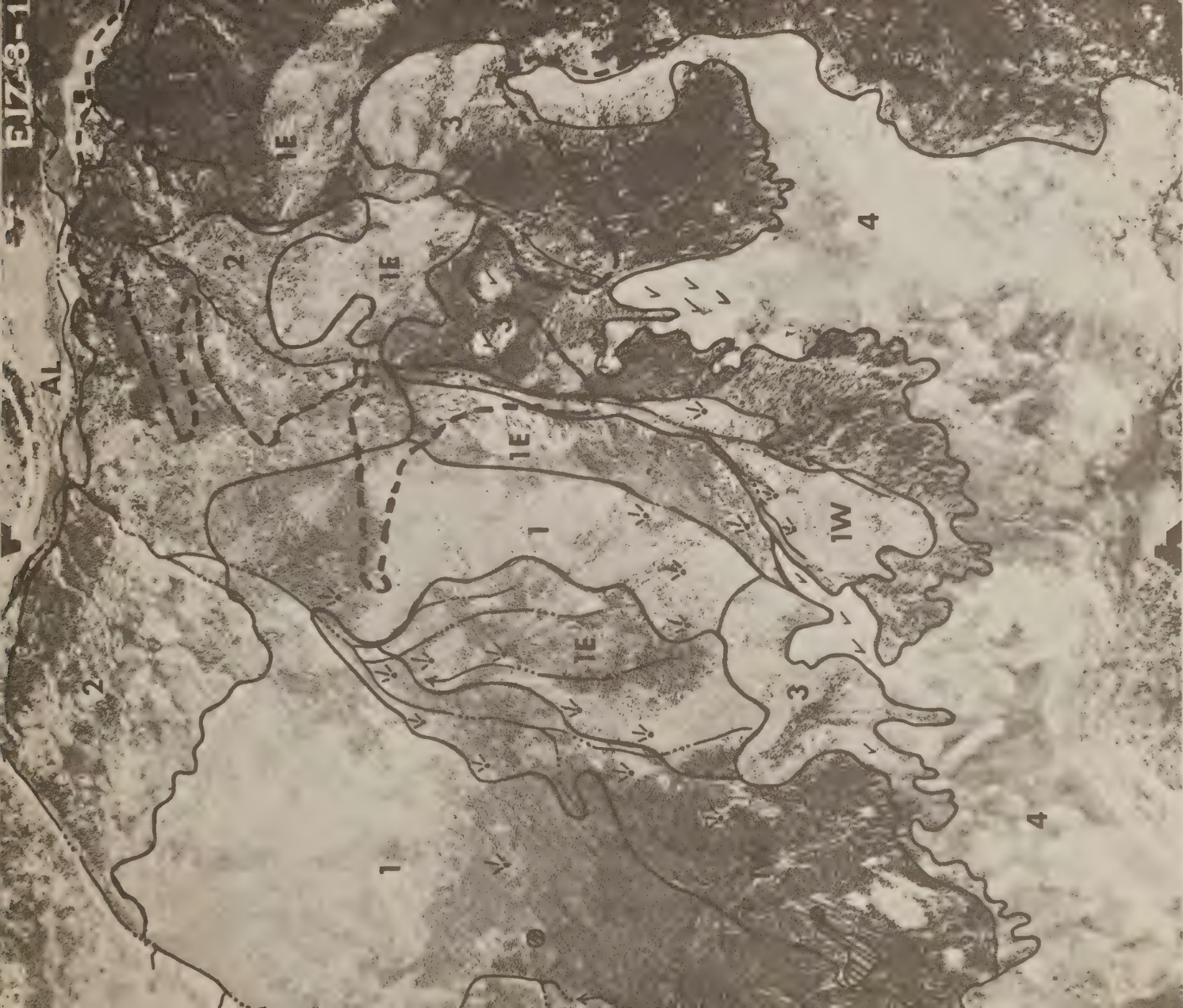
More comprehensive soil studies are needed during the conceptual development planning process, as a part of the interdisciplinary planning process. This identifies where problems exist. It is based upon soil examinations of the upper five feet of the earth's crust. Where deep soil situations are significant, or mass land instability is involved, the services of engineering geologists become involved.

Soil maps showing the extent and distribution of the different soils of the area may be needed to show soil descriptions. Soil descriptions are the recorded information of the physical and chemical soil characteristics of each soil body. Soil interpretations are derived from soil characteristics and the environmental influence of climate, geology, topography and vegetation.

Soil Studies should generally include:



1. Mass movement potential of the surface and underlying soils.
2. Erosion potential of surface soils if protective cover is disturbed.
3. Limitations for maintaining and reestablishing vegetation.
4. Soil drainage characteristics.
5. Soil limitations for road location and construction.
6. Soil limitations for sewage disposal.
7. Soil limitations for building foundations.
8. Soil limitations for ski runs.

Preliminary soils report map for Copper Mountain Ski Area. This identifies suitability for ski area development, hazards to be expected with various land practices, and limitations affecting development.



LEGEND

- wet spot \!/\
- rock-outcrop ✓
- stream —····→

- lake 
- building 
- road - - -

Scale: 1 : 20,000

SOIL STUDIES FOR CONSTRUCTION PLANS

When the most appropriate alternatives have been selected for installing facilities and locating ski runs, roads and other improvements, a detailed site analysis of the soils, relative to design, will usually be necessary. These studies provide detailed information for a specific section of the construction site. These problem areas, which are unavoidable in planning, need specific information for design to overcome limitations or hazards. The expertise of hydrologists, geologists and engineers are needed to design systems for fragile soils and hazardous sites. Deep borings, laboratory tests and detailed studies are often necessary. Specific prescriptions may also be necessary to ensure revegetation and stabilization of the site in order to prevent erosion or other soil problems during the winter or spring.

A variety of situations are shown here which should have been studied in greater detail before construction began.

Effect of earth fill on water courses.

Land slide activity.

Ability of steep soils to withstand spring snow melt without eroding (hill in background).

Stabilizing construction roads.

Reestablishing vegetation.





PREDICTION OF WATER RUNOFF PATTERNS AND STREAM FLOW

Ski runs in water courses may cause problems for a ski area operator if flowing water melts the snow. This is a common problem at several areas because the effects of water had not been studied before ski runs were planned. This can be a critical problem early in the winter when snow depth is minimal. Water should follow a natural course and be directed off of ski slopes. Culverts to carry water are expensive and must be designed to carry peak loads.

More often than not, nature did not shape the terrain for the desires of today's skiers. Slope modification may be necessary, at certain key locations, in order to get optimum use of the available area. For example, one steep area could discourage skiers from using an otherwise easy trail.

Hydrologic studies could have predicted that a stream would develop in the ski trail shown in the right of this photograph.

Bulldozed area (center trail-top) eliminated a steep area, permitting intermediate skiers to negotiate remainder of the trail.

Chair lift line blends in scattered timber (above) but creates harsh line in heavy timber (below).

The stream is trapped in the trail at the right. Snow is melted during early winter, affecting skiing. This water must be culverted and drained under the congested area near lift terminal (bottom).

Lift line area at bottom is located at trail junction. This can be hazardous.

Extensive bulldozing of the trails made soil stabilization difficult and time consuming.



AIR QUALITY STANDARDS

The concern for the environment has led to legislation, such as in the State of Colorado where procedures were established governing the burning of wood product waste and other materials. The Forest Service will be reviewing permittees' proposals for slash disposal. Alternatives to burning must be investigated, and used where advisable, before burning will be recommended.

There are various alternative means of disposing of wood products:

Commercial timber sales of merchantable logs or on-site conversion of logs to lumber for the development.

Burying of stumps and debris where good compaction can be obtained and where watershed values will not be damaged. Soil stability of fills must be provided. Material shall not be buried where flowing water can flow through uncompacted fill material. The surface of disturbed areas must be stabilized.

Medium size and smaller material can be chipped. Chips can normally be scattered into the timber, spread on the trails, used as fill, or sold.

Material can be cut and disposed of as firewood.

Burning can be authorized after other methods have been used or are inappropriate. Burning should be done during periods when smoke will be rapidly dispersed into the atmosphere. Special fans and pits can be used to force hotter burning, thus minimizing the amount of smoke dispersed into the air. Burning can be performed during periods of low or moderate fire danger. The permittee will be required to provide adequate fire fighting equipment and manpower to ensure safe burning practices.

If the ski industry cannot meet air quality requirements, or does not demonstrate a sincere effort to minimize air pollution, additional controls and less flexibility are almost bound to follow.

The smoke is dispersing well into the atmosphere because of the normal temperature gradient and the temperature differential which exists between the heated air and the atmosphere. Notice how the stable clouds blanket the mountains in the background. Smoke will react in a manner similar to the clouds during stable air conditions or temperature inversions.



INNOVATIVE CONSTRUCTION METHODS

The presence of road cuts across ski runs not only downgrades skiing quality, but may shorten the effective season if heavy snowfall is needed to cover roads. Cuts and fills also make snowpacking difficult. Roads may become a continuing maintenance problem and are often costly to construct. They may cause untenable esthetic damage, particularly if located, designed or constructed improperly. Esthetic or soil considerations may preclude them entirely.

The length of the construction season is critical to any ski area construction program. If roads must be constructed to lift tower sites, a large portion of the construction season may pass before actual lift construction can begin. Lift construction often extends late into the fall or early winter.

Area operators have found that chairlift tower installations by helicopter can save them time and money. Some ski area operators have been pumping concrete to tower sites without roads, at a considerable saving over moving concrete exclusively with helicopters.

Large construction helicopters are available to ski area developers. Portable cable logging systems, as well as rubber-tired log skidding machines, are also available for clearing of ski runs. Winter construction over-the-snow also offers promise for additional flexibility.

This helicopter is lifting complete chairlift tower assemblies to elevations over 11,000 feet at the Keystone Ski Area, near the Continental Divide, in Colorado.





ROADS AND DEVELOPMENT COSTS VS. SKIING

Snowpacking equipment cannot easily care for trails having abrupt road crossings, nor can skiers cross them easily or safely. Trails of intermediate difficulty become more difficult to ski if they are crossed with roads at steep locations.

Snowpacking machines should not cross ski trails at steep locations as they work their way up the hill. These routes become flat "benches" and downgrade skiing quality.

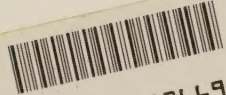
Skiing quality sells an area and the need for well-groomed slopes is well recognized.

Ski runs should be designed so snow maintenance equipment can operate efficiently.



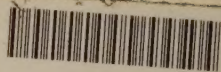
Information regarding development of resorts and ski areas on National Forests can be obtained from the Regional Foresters listed below:

Region 1	. . . . .	Federal Building, Missoula, Montana 59801
Region 2	. . . . .	Bldg. 85, Denver Federal Center, Denver, Colorado 80225
Region 3	. . . . .	Federal Building, 517 Gold Avenue SW., Albuquerque, New Mexico 87101
Region 4	. . . . .	Federal Building, 324 25th Street, Ogden, Utah 84401
Region 5	. . . . .	630 Sansome Street, San Francisco, California 94111
Region 6	. . . . .	319 S.W. Pine Street, P.O. Box 3623, Portland, Oregon 97208
Region 8	. . . . .	1720 Peachtree Road, NW, Atlanta, Georgia 30309
Region 9	. . . . .	633 W. Wisconsin Avenue, Milwaukee, Wisconsin 53203
Region 10	. . . . .	Federal Office Building, Box 1628, Juneau, Alaska 99801



R0001 182669

ca



R0001 182669

